Tag News

April 2003

TAG Update

INDEX

Tag Update.....1

Incentive awards....1-3

GST Strategic Plan 3

Intellectual Property....4

Technical Updates....4-7

Announcements and Awards.....8-9

TAG Submissions..10-11

Incentive chart.....12

Global Science & Technology, Inc.
7855 Walker Drive, Suite 200
Greenbelt, Maryland 20770

Over the last year, GST employees made many important contributions to NASA, DOD, and NOAA missions and projects, as well as to GST's own internal technical development activities.

To demonstrate corporate appreciation and commitment to delivery of high quality of science, service and support that reflects so advantageously on GST, about a year and a half ago, GST's Technical Advisory Group (TAG) began an activity to recognize technical contributions of GST employees with financial and other incentives. The program solicits all scientific and technical employees to share information about their published and publicly presented work, and encourages any GST employee to submit his/her own project proposal ideas to obtain GST corporate resources to pursue them. When you submit documentary evidences of your good technical work directly to TAG, it ensures highest corporate level visibility for your efforts.

The TAG financial incentives are provided to encourage three general categories of technical contributions:

1) To recognize work in progress, such as may be done for a NASA or other customer
2) To provide a step-wise process for initial development of employee-defined ideas possibly leading to GST investment
3) To provide corporate Bid and Proposal support to individual employees for pursuing research opportunities such as NRA's and SBIRs.

In this newsletter I want to share highlight some last year's participation in these TAG initiatives, and to encourage others, who similarly seek to raise their visibility within the organization and to pursue ideas of their own design. I want to show you how your GST colleagues responded to the program and how they benefited.

TAG Incentive Awards for Ongoing Technical Work

In calendar year 2002, 44 journal articles, book contributions, Technical Memoranda, and Conference preprints, posters and presentations submitted to TAG. Of these, 40 merited incentive awards that resulted in 24 individuals receiving incentive awards ranging individually from $50 to $500. Based on multiple contributions, nine individuals received $500 or more. Three individuals received over $1,000 for their submitted contributions. The incentive award schedule is shown again on the last page of this newsletter.

Your co-workers who received incentive awards are: Nadine Alameh, Alex Bier, Chris Blunck, Barbara Campano, Tina Chen, Dave Cottingham, Gregory Delo, Tony Gualtieri, Robert Harberts, Scott Johnson, Robert Mahoney, Mark Nestler, Maiteyree Pasad, John Pietras, Elizabeth Polidan, David Rapchun, Wei Xia-Serafino, Elmer Sharp, Weijun Su, Lori Tyahla, Augustyn Waczynski, Keith Wichmann, and Zhangli Yin. A list of titles of works submitted appears toward the end of the newsletter.

Funds for this program are in addition to current corporate bonus pool funds that are available for distribution through your program manager. Our motivation is to encourage and formally acknowledge employee participation in activities that bring visibility and professional credibility both to you and to GST as a company.

To be eligible for TAG consideration, you will be asked to document your technical contributions and to forward that documentation to TAG either directly, or through your program manager. A very simple form ("TAG Publication Incentive Award Application") is provided on the internal GST web site that you can use to describe the nature and relevance of the contribution. Attached to the form will be the documentation itself (e.g., journal paper, pre-print article, conference agenda, etc.).

TAG will examine the merits of each submission based on the degree to which a technical contribution provides broad positive professional / public exposure for you as a representative of GST. TAG will issue a bonus reward in the categories and amounts shown in the chart below on the last page of the newsletter.

Last year we disbursed only about half of what we had budgeted for incentive awards, and we're certain many individuals just did not take the time to submit their work. A corollary reason we hope everyone who is eligible will take advantage of the program, is that it provides metrics we need to continuously assess our scientific and technical performance and credentials against GST's vision, mission and strategic objectives.

Internal Research & Development (IR&D)

TAG Independent Research & Development (IR&D) funds are viewed as seed funds to allow an employee to pursue a particularly promising idea off-line from their government-sponsored work. TAG will review all such requests on the basis of the idea's technical soundness, mapping against corporate objectives, and likelihood that a GST investment in the research idea will result in significant technical advances and/or future opportunities. Please contact your program manager or TAG if you have an interest and motivation to tap into these funds. Last year TAG allocated over $70,000 to three projects and individuals:

*Bill Dickinson Jr. for development of a white paper on "**Development of GIS Predictive Archeological Models".*** As a result of the white paper we are exploring possibilities for a joint proposal with Sinte Gleska University (SGU) to apply GIS- based archeological predictive models to Native American Cultural Resource Management issues.

In a not un-related joint NASA SBIR proposal with GST, Earth Sat Corporation, and SGU, we proposed to develop a GIS "gazetteer" interface keyed to place names, locations and events in a Native American perspective and language. Although the proposal was not funded, the idea will be proposed elsewhere.

*Dr. Max Repaci for **"Development of a prototype GST External Telecom Network Protocol Testbed with Link Emulator"***. With a two-page prospectus in hand, Repaci met the TAG, and based on that initial discussions he was allocated sufficient hours to prepare a 10 page white paper. Based on the white paper, TAG is funding a 6-month effort to develop a telecom network simulation tool that will be used not only for GST's Skipware testing and development, but will also be enhanced with user interfaces enabling it to be offered commercially. Repaci's white paper lays out a market analysis and business case. This activity, which will begin in May, will involve two other GST staff and possibly a summer student intern.

Dr. Robert Bane for an IR&D project ***"XML Web Ruler".*** This TAG project was funded to develop a demonstration protype of a tool that uses LISP enabled AI concepts to discern rules and automate rule-based translation among burgeoning discipline-specific implementations of XML. A demonstration and seminar on this work was given on April 14 at Walker Drive, culminating a year's part-time development activity by Bane. The next stage is to decide whether GST should invest additional corporate resources into further development, or if these capabilities can add value to other GST technical initiative. For example, it has been suggested that the "Web-ruler" approach could be applied to good effect by the Geospatial Interoperability Group, or by the SCPS group.

Submitting Ideas for IR&D Support

Approaching TAG regarding an idea you might like to pursue is simple. First talk with your program manager, or speak with Mike Kalb, Fred Brosi, or Chiehsan Cheng. The first step will probably entail an hour of informal discussion with a 2-page concept paper or short PPT. If the idea resonates, you would be provided a corporate charge code for your labor to develop a short (10 pages) white paper to guide a GST decision whether to fund development of a prototype. In addition to technical issues, the white paper would typically provide some analysis of existing and potential markets, potential business strategies and partnerships, resources needed to develop a prototype, a schedule and milestones, and strategies for funding prototype. The final step would be authorization and internal funding to develop a prototype.

Do YOU have an idea? TAG has a budget and we are looking for at least three new concepts to support.

TAG Supported Proposals

TAG provided financial (B&P funds) and other support for two SBIR proposals, two REASoN, CAN proposals and one NRA Proposal (ESTO's AIST). Authors and Titles of these proposals are listed here.

NASA ESTO AIST

"Adaptation of SNMP to Stressed Networking Environments"; John Pietras & Jim Noles

NASA REASoN

"A Geospatial Extension to the NASA Information Power Grid" - Lois Takara & Celeste Jarvis with SGU, EarthSat, EROS Data Center, and NASA Ames as partners

NASA REASoN

"A Repository of Open-Source Industry Standard Tools" - John Evans and Nadine Alameh with Open Planning Project, as partner

NASA SBIR

"Satellite Curriculum for the K-12 Classroom: DirectMet for Educators" – George Schwenke to develop enhancements of DirectMet for K-12 education.

NASA SBIR

"A Culturally Relevant GIS for Resource Management" – Lois Takara, with EarthSat Corporation and Sinte Gleska University to integrate a system of geospatial component technologies to support mapping of information relevant to Native American culture and government.

GST Strategic Planning

You should be aware by now that GST is engaged in a systematic multi-year strategic planning effort to guide GST's future. Many of you know first hand because you have participated in the strategic planning exercises. The first *public* evidence of the strategic planning of this development was issuance of GST mission and vision statements and high-level strategies, which you received recently. Arriving at a unified mission and vision statement is the necessary first step that underpins all subsequent detailed strategic planning and execution.

GST Mission: *To apply our leading scientific and technical expertise toward solving the challenges fundamental to advanced science and technology-based enterprises*

GST Vision: *To capitalize on our unique knowledge and accomplishments to sustain our growth as a financially stable and responsible corporate citizen with increasing employee ownership*.

Both statements seem simple enough. They are. Arriving at these statements was not simple however, being the result of deep consensus building exercise among diverse GST elements. But the results are good, and I think will prove useful.

Mission and vision statements **are** intentionally broad, and it is first the responsibility of corporate management to demonstrate pathways that give them form and relevance to actual practice; and second the responsibility of each of us to understand how they might guide, not what we do daily, but how we approach what we do.

At a high level, **Strategic Objective C.1** from strategic plan states that GST will "*Be recognized as a supplier of choice for consistently providing the best technical solutions and high-quality value-added products, services and customer support satisfying the markets we serve.*"

At the next level are **specific objectives**, one of which is the eventual creation within GST of a virtual Research Division. Ultimately, functions of the TAG would become a subset of a Research Division whose goals will be to 1) organize and provide the infrastructure and services to pursue and conduct research; 2) seek external dollars for research and development, and 3) fund internal research projects supporting potential commercialization, community enrichment, and enhancing critical company qualifications. The division would also develop structure and process to spearhead company-wide R&D initiatives and coordinate all company R&D efforts, help focus and integrate these efforts, and strategically maximize our resources.

Recognition as a science and technology organization derives not from just *supporting* science and technology but from being visible and acknowledged as contributing intellectually to setting the vision, priorities, direction, organization of technical endeavors. We want to encourage principal investigators and provide entrepreneurial outlet, for those with such inclinations. While the TAG is quasi-informal, a developing Research Division would entail establishing ISO type processes and dedicated staff to support R&D from proposal development through project management assistance and resources.

Mike Kalb
Chief Scientist

SBIR / STTR 2003

Please note that the NASA SBIR 2003 Solicitation is due to be released July 7, 2003 (http:// sbir.gsfc.nasa.gov). The solicitation period: is July 7 - September 9, 2003, with selections being announced November 21, 2003

We strongly encourage GST technical employees, at minimum, to be aware of the SBIR (and STTR) program and to recognize the opportunity it presents to obtain independent research funds for projects of personal interest. An aim of the SBIR program (Phase I) is to provide funding to small businesses to develop innovative concepts emphasizing ideas with future commercialization potential (Phase II). SBIR's benefit GST by providing unencumbered internal research and development that would otherwise need to be drawn from more limited corporate resources. . You can benefit by being a PI or Co-I on a funded, self-directed project. We will send out a synopsis of program topic of possible interest to GST. Also, feel free to check out SBIR web sites for DoD, NIH, and EPA as well as NASA. The STTR program is like the SBIR except that it requires at least 40% participation by a university partner.

With a Phase I SBIR you can receive up to 70K for a six-month proof of concept effiort. (Follow-on Phase II awards are for up to 600K). All SBIR/STTR awards are competitive and require a proposal. If you have an interest and an idea, please contact Mike Kalb as soon as possible. If you propose an idea that appears to have a reasonable chance of success, GST will provide B&P to develop the technical proposal, and will devote "people" resources to help sort through and meet the administrative requirements.

Intellectual Property: What's in a Name?

By Sally Stemwedel

A "good name" can have quite a lot of value for its owner. Just as *your* good name is worth protecting so that you are known to be trustworthy, industrious, honorable, and worth knowing, our company's good name is worth protecting too.

Think of **GST trademarks** in the same way as you think of names of your own family members. We want customers to learn our trademarks. So we must use them correctly and build their association with positive attitudes toward our company and its products.

When we develop a new product at GST, we devise a marketing strategy and choose a name to identify the product. We need to choose a name that is unlike any other name for similar goods in our markets, so the name will define GST as the source of the product.

As soon as GST uses a trademark to identify a product or service, we have claimed rights to the mark. Our rights to use the mark grow the longer we use it, and the more places we do business using the mark. But to secure our rights to use the mark throughout the US without marketing everywhere at once, GST can register the new trademark with the U.S. Patent and Trademark Office (USPTO).

We can only identify our trademark as "registered" after we have completed the entire registration process with the USPTO and been notified that the mark has attained registration. Only then is it a "registered trademark", and we can use the circle-R symbol (rather than TM) with the trademark. At this time, GST owns three registered trademarks:

Global Science & Technology, Inc.

DIRECTMET®

SKIPWARE®

All of us at GST work hard to maintain the company's reputation for quality. Because of that, GST's products and services have become identified with quality. Use our corporate trademark proudly as part of your identity in your workplace.

Contact me with questions or comments: stemwedel@gst.com
I am happy to work with individuals or groups on IP issues.

Disclosing Technology to NASA/GSFC

Many of GST's GSFC contracts require that we report technology developed under the contract using NASA form **1679, Disclosure of Invention and New Technology (Including Software).** If you must provide information for a **1679**, we can help. Look at http://inside.gst.com/ and Intellectual Property for

- Blank NASA **1679** (.doc format)
- How to file NASA form 1679, training presentation

Or contact Sally Stemwedel, stemwedel@gst,com, 240-542-1163

Please give Sally Stemwedel a copy as soon as it is filed, because that starts the clock counting down on GST being able to assert any intellectual property rights.

Technical Updates

Space Link Extension Services

By Fred Brosi

ESA and NASA have implemented the cross support capabilities provided by the Space Link Extension (SLE) transfer services for the International Gamma Ray Astrophysics Laboratory (INTEGRAL) mission. INTEGRAL was launched in October 2002 and is transferring data between the two space agencies by using the CCSDS Panel 3 Recommendations for Forward Command Link Transmission Unit (F-CLTU), Return All Frames (RAF), and Return Channel Frames (RCF) transfer services.

SLE transfer services provide a standard method to transport spacecraft forward and return data between ground stations, control centers and datauser facilities. These services utilize the existing CCSDS Recommendations for packet telemetry and command for the space link and extend their transfer through the ground system.

The F-CLTU service enables control center operators to provide CLTUs for uplink via an established forward space link physical channel to the spacecraft. The RAF service provides the stream of telemetry frames from a single space link physical channel to spacecraft operators and other users. INTEGRAL is also utilizing the RCF service that delivers a Master Channel or specific Virtual Channels specified by the service. RAF, RCF, and F-CLTU require service management to control the scheduling and provision of these transfer services. An ad hoc management scheme is being utilized for the operational missions while the CCSDS Recommendation for Service Management is being developed. The RAF and F-CLTU Recommendations are available at www.ccsds.org. RCF is currently being finalized.

SLE services enhance interoperability by establishing a standard for services to be used in the area where most cross-support activity occurs – between the tracking stations or ground data handling systems of various organizations and the mission-specific components of a mission ground system. The SLE services are applicable to routine, contingency, and emergency operations. Mission risk is reduced since standard SLE services facilitate the rapid substitution of ground stations in the event of a failure. Since the SLE protocols run over existing communications infrastructure and utilize TCP/IP protocols, they help integrate Space Data Systems into the global communications network.

In addition to the INTEGRAL mission ESA's European Space Operations Center (ESOC) and NASA/Jet Propulsion Laboratory (JPL) will use the RAF, RCF, and F-CLTU transfer services for the Mars Express mission scheduled for 2003. 2

Other current and planned implementations of SLE services by space agencies are:

Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) – DLR will implement SLE services in two of its ground stations in Germany to support the TerraSAR and SARLupe missions.

National Space Development Agency of Japan (NASDA) and Institute of Space and Astronautical Science (ISAS) – Cross support will be provided by SLE services for the MUSES-C, Solar-B, and DRTS missions.

British National Space Centre (BNSC) – A prototype SLE system has been developed by VEGA Group PLC and is installed in a QinetiQ ground station in Scotland. The Rutherford Appleton Laboratory (RAL) is planning to install a similar system to provide cross support.

NASA Goddard Space Flight Center (GSFC) – A study team has investigated the phase-out of the NASA ground communications services based on Nascom blocks and concluded that CCSDS SLE meets the objectives of future science missions for the Space Network (SN), Ground Network (GN), and Deep Space Network (DSN). NASA now requests that Project Operations Control Centers utilize a standard SLE services interface for transferring data to and from DSN and SN sites.

CCSDS Lossless Data Compression in HDF-4 AND HDF-5 for EOSDIS

By Wei Xia-Serafino

EOSDIS manages data from NASA's past and current Earth science research satellites and field measurement programs, providing data archiving, distribution, and information management services. Over a terabyte of data will be produced daily by the EOS project. The transmission and archiving of such an unprecedented amount of data requires tremendous computing time, computer storage, and I/O bandwidth. One technique that can reduce the total data archive storage and network connection time requirement, without compromising data fidelity is, *lossless data compression.*

The most commonly used lossless data compression technique is the Lambel-Ziv-Welch (LZW) based algorithm (e.g. gzip or its' variations). This technique generally yields poor compression ratios on data originating from spacecraft instruments. A second well-established technique is arithmetic coding (e.g. JPEG arithmetic coding). This technique works on most types of data, but exhibits relatively slow speed due to the need to update statistics during the process. The Consultative Committee on Space Data Systems (CCSDS) has adopted the extended-Rice algorithm as the recommendation for international standards for space applications. This technique was developed specifically for science instrument data by a joint effort between NASA GSFC and Jet Propulsion Laboratory (JPL), based on requirements for high speed real time processing, low complexity, and quick adaptation to statistics. It has been implemented for many space missions in both instruments and data systems and baselined for many future satellites as well.

In 1998, ESTO/ESDIS (Karen Moe) supported a prototype study to evaluate the performance of these different data compression techniques on EOS data. The prototype study was performed Dr. Pen-shu Yeh (Code 564, GSFC) and Wei Xia-Serafino (GST). The performance of different lossless data compression techniques was compared on typical EOSDIS HDF-EOS data files. Two measurements, speed and compression ratio (CR), were used as the comparison criteria. The algorithms evaluated were Unix compress, Gzip, JPEG Arithmetic coding, and CCSDS lossless data compression (Szip). They were tested on a Sun Sparc20 workstation running the Unix operating system. The prototype study results demonstrated that the performance of CCSDS lossless data compression technique is superior, both in the compression ratio and the compression speed for science data. Table 1 shows the summary comparison results. Values in the table represent the averages over the all data products. *(see table 1 on page 6)*

During 1999 and 2001, led by Dr. Ben Kobler (GSFC Code 586), a further study on the feasibility of using CCSDS compression for real-time processing in EOS data system was performed by Dr. Pen-shu Yeh and Wei Xia-Serafino. Gigabytes of MODIS real sensor data were tested on an EOS CORE SYSTEM (ECS) operational machine. The results showed that the Szip compression time on the ECS production machine for a typical set of MODIS products (one granule including 1km, 500m and 250m resolutions) is about 3 minutes. In comparison, it takes almost one hour to compress the same data sets with Gzip. Only the Szip compression speed is suitable for the ECS operations since the compression time for a granule is relatively small (~ 10%) compared to the time it takes to generate one granule of Level-1B data from Level 0 data. A scalability analysis model was established by Dr. Daniel Menasce (GWU) to assess the cost savings from using CCSDS

lossless data compression in the ECS operational system. This was done based on the data volumes archived and distributed at the GSFC DAAC. The scalability model is used to assess cost savings from using Szip as a data compression algorithm for two scenarios: (1). SZDC - compress before storing and distribute in compressed form; and (2). SZDU - compress before storing and uncompress before distributing. SZDC saves bandwidth and network transmission time over SZDU but requires users to decompress files. Utilizing the DAAC hardware tape compression (1.5:1 compression) for Level 0, and Szip compression for Level 1 and above data, storage and network savings over an 8-year period at the GSFC DAAC are shown in the Table 2. *(see table 2 on page 6)*

Based on the results, ESDIS recommended implementing the lossless data compression algorithm, *Szip* in the HDF library. The HDF project involves the development and support of software and file formats for scientific data management. The HDF software includes I/O libraries and tools for analyzing, visualizing, and converting scientific data. EOSDIS uses the Hierarchical Data Format for EOS (HDF-EOS), developed as an extension to NCSA's HDF, for archiving and distributing data. The current version of HDF4 has already supported lossless data compression algorithms – Run Length Encoding (RLE), Skipping Huffman (SKPHUFF), and Gzip compression (Lempel/Ziv-77 dictionary coder, named Deflate) SDS interface and GR raster image interface. The current version of HDF5 supported the Gzip compression only. Implementing the CCSDS lossless data compression into the HDF library provides a transparent method for users to capitalize on reduced data volumes since the HDF library contains an interface for storing and retrieving compressed or uncompressed data.

After a two-year collaboration within NASA, NCSA and University of Idaho, the CCSDS lossless data compression will be released from NCSA in HDF4 and HDF5.
At the time of this writing, HDF4.1r5 and HDF5-1.4.5 have been released. A new version of HDF4 that includes the CCSDS lossless data compress (szip), along with the supporting utility programs has scheduled to be released in July, 2003. The HDF-5 new version with szip has scheduled to be released in May, 2003.

	Szip	Gzip	Cz	Az
CR	3.24	2.44	2.06	2.38
Compress (seconds)	353	8112	1973	10516
Decompress (seconds)	394	1264	790	7341

Table 1. Phase I Result Summary

Scenario	Additional Cost ($K)	Storage Savings ($K)	Net Savings ($K)	Total Network Savings ($K)	Net Savings w/Network ($K)
SZDC SZDU	$-$100	1,547 1,547	1,547 1,447	486	2,033 1,447

Table 2. Total savings using Szip at GSFC DAAC

An Interface Specification for Requesting SpaceLink Extension Services from NASA TT&C Networks

By John Pietras

The Consultative Committee for Space Data Systems (CCSDS) with significant involvement of GST has produced Recommendations (specifications) for several Space Link Extension (SLE) transfer services for the standardized, interoperable exchange of spacecraft telemetry and command data between a spaceflight mission's ground facilities and the tracking, telemetry, and command (TT&C) networks that are used to communicate with the mission's spacecraft. The European Space Agency (ESA) and the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL) Deep Space Network (DSN) have implemented these SLE transfer services. Other space agencies are prototyping SLE services, several spaceflight missions have already adopted SLE, and JPL has adopted SLE as the standard interface between mission facilities and the DSN for the foreseeable future. NASA's Space Network (SN) and Ground Network (GN), as well as other national space agencies, are evaluating the adoption of SLE services as their standard for future mission support.

The type, number, and operational characteristics of the SLE services can vary from mission to mission, resulting in the need for management interaction between the mission and the supporting TT&C network. This management interaction nominally includes:

- Pre-flight agreement(s) between the mission and the TT&C network that specify the limits on types, numbers, and operational characteristics of the SLE services to be provided over the mission lifetime
- Requests for service on a per-pass basis. Such requests may contain values for SLE service parameters if those parameters have not been fixed for the lifetime of the mission in the pre-flight agreements
- Requests to modify the values of certain SLE service parameters during the pass
- Transfers of SLE service status information
- Responses to the various requests (e.g., confirmation of the original request, return of requested information, etc.)
- Notifications (e.g., change in status of ability to support service)

As a companion activity to the specification of the SLE transfer services, CCSDS has developed a detailed framework for a management interface through which a mission may request SLE services and modify and monitor their execution.

NASA has begun to apply and adapt the CCSDS SLE service management framework to a concrete specification written in the eXtensible Markup Language (XML). XML is emerging as the premier standard for automated information exchange, and its use in this specification will enable the automation of service request exchanges using XML-based tools and technology. The objective of this activity is to produce a specification that addresses not only the specific needs of NASA's DSN, GN, and SN, but also (through coordination in CCSDS) the SLE service management cross-support needs of the international space community. A key component of this activity is a prototyping effort to test and demonstrate the specification's functionality, usability, and adaptability to NASA's TT&C networks. The goal is to have the specification available for implementation in the SN, GN, and DSN by autumn of 2003.

A white paper authored by John Pietras and JPL colleagues, available on the GST Web-site, provides a detailed overview of the NASA XML-based SLE service management interface, progress to date, and future plans.

Digital Earth PC

By Alex Kekesi and Eric Sokolosky

Over the last five years, the GST-staffed Scientific Visualization Studio (SVS) at NASA/GSFC built a prototype Digital Earth Workbench that provides an immersive, interactive interface to a three-dimensional model of the Earth, and links directly to network-accessible geospatial data archives (http://webserv.gsfc.nasa.gov/DE-Workbench/). Among other functionality, the software enables 3-D display and animation of temporally changing data throughout the Earth system, and terrain flybys. That system has generated significant interest among museums and educators. However, because it was developed for high-cost computing platforms and immersive devices, use of such a system by these communities was impractical — until now.

GST's SVS team personnel are involved in a NASA technology initiative to port The Digital Earth Workbench software to a commodity computer. The envisioned "Digital Earth PC" will be cost-effective for both informal education sites and school media centers and will provide web-based access to geospatial data holdings of NASA and other federal agencies. This is possible owing to advances in commodity graphics processing power, and network access to information using Open Web Services (OWS) geospatial data access standards.

The use of the OGC Web Services (OWS), standards, developed through collaboration between the federal government and industry, facilitate commercial and educational access to geospatial data holdings in the public and private sector. One educational activity currently using the OWS standards is the GLOBE Program (http://www.globe.gov).

Geospatial data span space scales from thousands of kilometers to a few meters, and temporal scales range from a few minutes to millennia. Given these scale ranges and the massive amounts of data involved, a general viewer for such data must implement level-of-detail (LOD) algorithms which only access and display the portion of the data relevant to a particular investigation. The technologies chosen for this project both use a form of LOD. The graphics toolkit used in the display system, SGI's Performer, implements LOD by only displaying in the viewing system only what the user can perceive visually at any particular moment. This leads to a high performance level, even when the user is traversing many orders of magnitude in scale. The data access mecha-

nism, the OWS protocol, implements LOD by including a specific protocol for requesting both the spatial and temporal ranges and resolutions in a request to an archive. In this way, only the particular data required is transmitted across the network from the data archive, which creates efficiencies at the archive and network levels.

The Performer toolkit and the OWS client protocol software are resident on the Digital Earth PC. The Digital Earth PC software uses the Performer toolkit to control the hardware graphics and to create the 3-D display. The OWS client protocol software mediates access to remote data archives, while the OWS server and catalog protocol software resides on remote data server and deals with data discovery, formatting and geospatial projection issues.

There are three partners for this project: Silicon Graphics, Inc., which is providing graphics software technology, NASA's Geographic Interoperability Office which will provide consultation on OWS implementation and standards, and GLOBE Program which will participate in the development and testing.

Announcements and Awards

Robert Mahoney Co-authored an Award Winning Paper

Robert Mahoney, along with lead author Assaf Anyamba (UMBC) and co-authors Kenneth Linthicum & Patrick Kelley (Walter Reed Research Inst.) and Robert Compton Tucker NASA) was 1st place recipient of the 2003 American Society of Photogrammetry and Remote Sensing John I. Davidson award for Practical Papers. The award will be presented at the 2003 Annual conference of the ASPRS this May in Anchorage, Alaska. The abstract of their paper entitled "Mapping Potential Risk of Rift Valley fever outbreaks in African Savannas using Vegetation Index Time Series Data" (PE&RS; 68-2, pp 137-145). Is reproduced below.

Abstract

Rift Valley fever (RVF) outbreaks in East Africa are closely coupled with above normal rainfall that is associated with the occurrence of the warm phase of the El Niño / Southern Oscillation (ENSO) phenomenon. Outbreaks elsewhere in central and southern Africa are also linked to elevated rainfall patterns. Major RVF activity has been reported to occur throughout much of sub-Saharan Africa, except in areas with extensive tropical forest. In this study we used normalized difference vegetation (NDVI) time-series data derived from the Advanced Very High Resolution Radiometer (AVHRR) instrument on polar orbiting National Oceanographic and Atmospheric Administration (NOAA) satellites to map areas with a potential for an RVF outbreak. A 19-year NDVI climatology was created and used to discriminate between areas with tropical forest, savanna, and desert. Since most RVF, outbreaks have occurred in regions dominated by savanna vegetation we created a mask to identify those areas where RVF would likely occur within the savanna ecosystems. NDVI anomalies were then calculated for the entire time series from July 1981 to the July 2000. Subsequently, we developed a methodology that detects areas with persistent positive NDVI anomalies (> + 0.1 NDVI units) using a 3-month moving window to flag regions at greatest risk. Algorithms were designed to account for periods of extended above normal NDVI (by inference rainfall) and to consider the complex life cycle of mosquitoes that maintain and transmit RVF virus to domestic animals and people. We present results for different ENSO warm and cold event periods. The results indicate regions of potential outbreaks have occurred predominantly during warm ENSO events in East Africa and during cold ENSO events in Southern Africa. Results provide a likely historical reconstruction of areas where RVF may have occurred during the last 19 years. There is a close agreement between confirmed outbreaks between 1981 and 2000, particularly in East Africa, and the risk maps produced in this study. This technique is adaptable to near real time monitoring on a monthly basis and may be a useful tool in RVF disease surveillance.

Charge Transfer Efficiency Restoration in a Radiation Damaged CCD

By Augustyn Waczynski, Scott D. Johnson, Elizabeth Polidan, Greg Delo

Space missions using charge-coupled devices (CCD) experience severe performance degradation due to the space radiation environment, especially a significant reduction of Charge Transfer Efficiency (CTE). CTE reduction causes random loss of the signal during device readout and degrades photometric accuracy. Figure 1 shows a stacking plot of a 55Fe image taken with an undamaged CCD. Note that the k-alpha line shows the same signal intensity on the left side of the plot (closest to the readout amp) as it does on the right side of the plot (furthest from the readout). Figure 2 is a stacking plot of an 55Fe image taken with a CCD that has been irradiated with the equivalent dose of 5 years in orbit. Note that the k-alpha line loses significant charge on those events occurring further from the readout.

Multiple correction techniques and mitigation methods have been attempted. Correction techniques are based on the assumption that CTE damage is uniform across a whole detector, they do not account for the random nature of interaction between traps and a charge packet or the random distribution of these traps over the device. They correct for average signal loss, but they do little to improve photometric error.

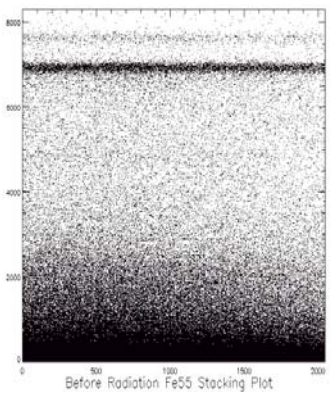
Perhaps the most common mitigation technique is the so-called 'fat zero'. Fat zero is the application of an optical or electrical signal, which is introduced uniformly to each CCD pixel before readout. It serves to fill traps and results in improved CTE for the signal. Its main disadvantage is the increased noise due to the shot noise of the fat zero and irreproducibility and non-uniformity of injection. Also, while it serves to somewhat restore the CTE, it cannot correct for the random effects of traps (CTE noise).

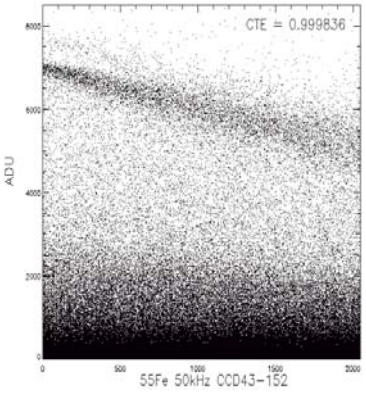
Extensive studies of radiation effects and mitigation techniques were performed within the WFC3 project. In particular, our team performed ground-based radiation testing of WFC3 detectors and investigated CTE dependence on CCD design, temperature, clocking and fat zero by optical bias and electrical injection.

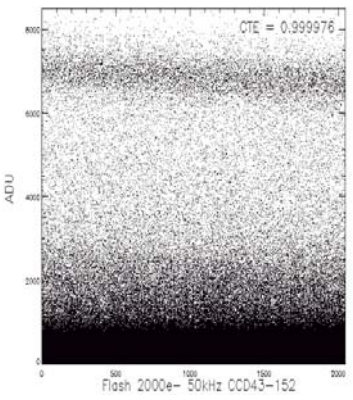
The WFC3 CCDs have built in Dump/Injection drains and associated Transfer Gates, structures used to facilitate rapid clearing of the CCD charge before exposure. We have used these structures to inject charge into the CCD to create a fat zero. Careful optimization of this process led to exceptionally good results. We have obtained almost full restoration of the initial CTE for the CCDs with 5 years service equivalent radiation damage. A damaged CCD CTE of 0.999836 has been restored - with charge injection - to a level of 0.999995 (we measured 0.999998 before irradiation). The total noise observed in our method is less than 15 electrons rms. This level of improvement could not be obtained with optical fat zero since the noise would be prohibitive.

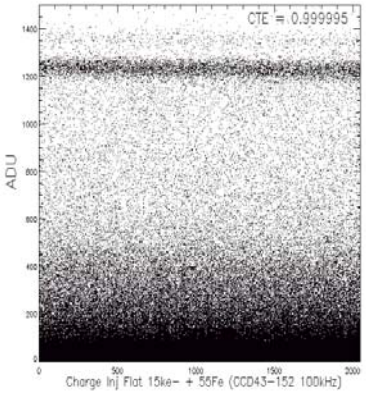
Figure 3 is a stacking plot of a 55Fe image taken on the 5 year damaged device, with an optical fat zero applied. Note that the k-alpha line, while almost restored to its original levels, is much wider than that of the undamaged CCD. The CTE noise has not been reduced. Figure 4 shows an 55Fe k-alpha line that has been restored with charge injection. Not only is the signal level almost completely restored, but the tightening of the line shows that the CTE noise has been greatly reduced.

Charge injection has been selected as the primary method of CTE mitigation for the CCD channel of WFC3. To our knowledge the CTE mitigation technique developed by our team far exceeds results obtained by any other group.









2002 TAG SUBMISSIONS

Nadine Alameh
Conference paper: "The Frontier of GIS: GIS Web Services"
Conference paper: "IS Web Services: Evolution and Impact on Urban and Regional Information Systems
Conference paper: "Chaining GIS Web Services";

Jason Behr, Evan Kunes and Tom Hait
Peer reviewed paper: "The HAWC and SAFIRE Adiabatic Demagnetization Refrigerators"

Chris Blunck
Conference paper: "Rapid Development with Python"

Tom Bridgeman
Un-Reviewed Paper: "Effects of Background Counts in RMS Normalization"

Tina Chen
Reviewed conference paper: "Spectral Contrast Enhancement Techniques for Extrasolar Planet Imaging"

Tina Chen, Alex Bier
Reviewed conference paper: "Micro-Machined Tunable Fabry-Perot Filters for Infrared Astronomy"

Tina Chen, Alex Bier, Barbara Campano
Reviewed conference paper: "Planar Large Format Monolithic Bolometer Arrays for Far-Infrared and Sub-millimeter Applications "

Tina Chen, Alex Bier
Conference Poster: "Programmable 2D masks for the NGST NIRSpec".

Dave Cottingham, Alex Bier, Barbara Campano, Tina Chen, Elmer Sharp
Reviewed conference paper: "Development of Frequency Selective Bolometers for Ground-based MM-Wave Astronomy"

Dave Cottingham, Tina Chen
Reviewed conference paper: "The Spectral Energy Distribution Camera for the LMT"

Tony Gualtieri
Peer reviewed paper: "The Feynman Propagator from a Single Path "
Conference paper: "Heirarchical Segmentation of Hyperspectral Data"

Robert Harberts, Larry Roelofs
Reviewed conference paper: "Concepts for Models and Visualization in Future NASA Science Enterprise Systems

Michael Kalb
Conference poster & paper - "Future Architectures For Operational Forecasting: Two-Way Interacting Sensorweb And Model / Assimilation System".

Mark Nestler
Conference poster: "The NASA Earth Observing System Data Gateway"

Robert Mahoney
Peer reviewed paper, "Climatic and Ecological Context of the 1994 – 1996 Ebola Outbreaks"
Conference poster,: Remote Sensing of Vegetation and Fire Dynamics During Safari 2000
Peer reviewed paper: "Mapping Potential Risk of Rift Valley Fever Outbreaks in African Savannas Using Vegetation Index Time Series Data"
Conference paper: "Directional Effects in Observations of Land Surface Temperature with AVHRR over Africa
Peer reviewed paper: "From El Nino to La Nina: Vegetation Response Patterns over East and Southern Africa during the 1997 – 2000 Period"

John Pietras
Conference paper: "An Interface Specification for Requesting Space Link Extension Services from NASA TT&C Networks"

David Rapchun
Conference poster: "Microshutter Arrays for the NGST NIRSpec"
Conference paper: "The LEISA / Atmospheric Corrector (LAC) on EO-1"
NASA Tech. Memo: " LabVIEW Interface Concepts Used in NASA Scientific Investigations and Virtual Instruments"
NASA Tech. Memo: "The New Cloud Absorption Radiometer (CAR) Software: One Model for NASSA Remote Sensing Virtual Instruments"
Book Contribution: "LabVIEW Interface Concepts Used in NASA Research" in LabVIEW GUI / Essential Techniques,.
Conference poster: "Programmable 2D masks for the NGST NIRSpec".
Conference poster : "Cryogenic Temperature Tunable Solid Fabry-Perot Spectrometer for the Near IR"
Conference poster "Microshutter Arrays for JWST – Programmable Field Masks".

Wei Xia-Serafino
Conference paper: "Implementation of CCSDS Lossless Data Compression in HDF"

Lori Tyahla
Peer reviewed paper: "Comparing the Degree of Land-Atmosphere Interaction in Four Atmospheric General Circulation Models"

Lori Tyahla, Weijun Su
Conference poster "HDF-EOS Tools and Information Web Site", American Geophysical Union meeting, San Francisco, CA
December 6 – 10, 2002

Augustyn Waczynski, Gregory Delo, Scott Johnson, Elizabeth Polidan
Peer reviewed paper: "A Comparison of Charge Transfer Efficiency Measurement Techniques on Proton Damaged n-Channel CCD's for the Hubble Space Telescope Wide-Field Camera 3"

Keith Wichmann
Conference paper: "ECHO Responds to NASA's Earth Science User Community"
Conference paper: "ECHO – A Message-Based Framework for Metadata Service Management"
Conference poster: R "Earth Observing System (EOS) ClearingHouse (ECHO): A Framework for Sharing Community Data,
Services and Tools"

Keith Wichmann, Maiteyree Pasad
Conference paper: "ECHO – A Message-Based Framework for Metadata Management"

Zhangshi Yin
Conference poster: "HDF-EOS and Metadata Updating and Verifying Tools"

A Final Note ....

The "TAG", or Technical Advisory Group exists to coordinate policies intended to secure benefits for GST and its employees that derive from their scientific and technical endeavors. Among its functions, TAG is to be venue for issues that impact GST's growth and reputation as a science, engineering and technology company. TAG coordinates the decision-making process regarding the allocation company resources to proposed new initiatives, which include employee-defined proposals and ideas.

We want this TAG newsletter to be a venue for communication on issues that concern your professional interests in relation to GST's directions and policies. If you want to put policy questions and comments in writing, we'll put them in the newsletter with responses. You can address these to me directly at tag@gst.com or kalb@gst.com, or discuss them with your manager who can bring any issues to the attention of the TAG.

We also want to use this newsletter to publish short write-ups on your work and that of your group. Your program manager will be soliciting short articles (250 – 500 words) from individuals to be included in future issues of this newsletter. You need to know what your fellow GST employees are working on. They deserve to know what you are doing.

Mike Kalb
Chief Scientist

TAG Employee Incentive Rewards

Employee Contribution	Bonus	Other GST Contribution
Peer Reviewed Publication		
1st Author	$500*	Page Charges (if needed)
2nd Author	$500*	

*maximum of $1,000 per paper; if more than 2 authors, $1,000 will be split equally among all GST authors

Professional Conference		
Session Chairman	$300	Domestic Travel (if needed)
1st Author Preprint	$250	Page Charges
nth Author Preprint	$100	
Oral Session Presenter	$250	Domestic Travel (if needed)
1st Author Poster	$200	
Poster Presenter	$150	Domestic Travel (if needed)
Professional Committee Service Appointment		
Committee Chair	$1,000	Domestic Travel (if needed)
Committee Member	$250	Domestic Travel (if needed)
• Professional Society	$500	
• Government	$250	
• Industry	$250	

Editor: Mike Kalb

Designer: Steven Stuart

Contributors: Fred Brosi, Greg Delo, Scott D. Johnson, Alex Kekesi, John Pietras, Elizabeth Polidan, Eric Sokolosky, Sally Stemwedel, Augustyn Waczynski, and Wei Xia-Serafino

If you have any questions or suggestions regarding this newsletter, please contact Mike Kalb at kalb@gst.com.